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10. Study on High Dielectric Constant Ceramics. (XIV)

Generation of Powerful Supersonic Wave Using $BaTiO_3$ Ceramic Vibrator

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Recently, the application of $BaTiO_4$ ceramics to acoustic purpose has attracted much attentions in various fields. The authors have already carried out the fundamental researches on the dielectric or piezoelectric properties (K. Abe T. Tanaka: Denki Hyoron, **37**, No. 4 (1949), 2; **38**, No. 4 (1950), 2), and the development researches applying this material to phonograph pickup or underwater sound transmitter or receiver, etc. (K. Abe, T. Tanaka and co-workers: this Bulletin, **24**, 65, **26**, 72-75).

It may easily be understood that this material is also very useful as a vibrator for the powerful supersonic generator. So the authors carried out an experiment to realize this idea. A high frequency oscillator and supersonic vibrator, suitable for practical use, were constructed and tested.

The vibrator element used in this experiment consisted of almost pure $BaTiO^3$ ceramics, whose thickness and diameter was about 5 mm and 60 mm respectively, and the resonant frequency was accordingly about 500 kc. The both surfaces of this element were previously coated with silver electrode.

To support this vibrator element, a ring type insulator (inside diameter: 62 mm, outside diameter: 100 mm, thickness 5 mm) was prepared, and three bronze strips were attached on each surface of this insulator, which were used as elastic holders as well as current feeders. The vibrator was placed at proper distance from brass reflector and immersed in an oil filled glass vessel whose diameter and depth was about 20 cm and 30 cm respectively.

As the coercive force of pure $BaTiO_3$ ceramics is 5~6KV/cm, it is desirable to apply a biasing field to obtain apowerful electrostrictive vibration. The high tension D.C. source of the high frequency oscillator can be appropriated for this purpose. The internal impedance of vibrator is considerably small as compared with that of quartz vibrator, and so it is generally required to step down the high frequency voltage for impedance matching.

As an oscillator tube, UV-594A was employed, and its maximum output was about 1.5KW. The high frequency voltage applied to the vibrator was about 250V and the current across it was about 4 A. Acoustic power of 500 watt could be easily generated by a single vibrator element. The spray of oil attained more than 50 cm high above the oil surface.